CLAIMS

What is claimed is:

1. A method of determining received signal impairment correlations for use in received signal processing, the method comprising:

providing a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters; and

adapting each of the model fitting parameters responsive to recurring measurements of the received signal impairment correlations.

2. The method of claim 1, wherein providing a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters comprises providing a model that at least includes an interference impairment term scaled by a first fitting parameter and a noise impairment term scaled by a second fitting parameter.

3. The method of claim 2, wherein adapting each of the model fitting parameters responsive to recurring measurements of the received signal impairment correlations comprises measuring received signal impairment correlations at each of one or more successive time instants and fitting the model to measured received signal impairment correlations by adapting values of the first and second fitting parameters.

4. The method of claim 3, wherein adapting each of the model fitting parameters responsive to recurring measurements of the received signal impairment correlations comprises, for fitting the model, determining the model fitting parameters as instantaneous fitting values or as filtered values obtained from successively determined instantaneous fitting values.

5. The method of claim 4, wherein a received signal being processed comprises a Wideband Code Division Multiple Access (WCDMA) signal, and wherein the model fitting parameters are adapted at successive time instants corresponding to WCMDA signal timeslots.

6. The method of claim 2, further comprising initializing the model by setting the first fitting parameter to zero and setting the second fitting parameter to a positive value.

7. The method of claim 1, wherein providing a model of received signal impairment correlations comprises one of providing a combined model of received signal impairment correlations for two or more received signals of interest, or providing a model of received signal impairment correlations for each of two or more received signals of interest.

8. The method of claim 1, wherein a received signal being processed comprises a wireless communication network signal, and wherein providing the model of received signal impairment correlations comprises providing a model that includes two or more of a same-cell interference impairment term scaled by a first fitting parameter, a noise impairment term scaled by a second fitting parameter, and an other-cell interference impairment term scaled by a third fitting parameter.

9. The method of claim 1, wherein providing a model of received signal impairment correlations comprises providing an interference correlation matrix scaled by a first model fitting parameter and a noise correlation matrix scaled by a second model fitting parameter, and wherein elements of the interference correlation in the model are determined from channel estimates corresponding to one or more received signals of interest.

10. The method of claim 9, wherein adapting the model responsive to recurring measurements comprises computing a plurality of channel estimates over each one of repeating

time slots, measuring impairment correlations from the channel estimates, and calculating updated model fitting parameters for each slot based on the measured impairment correlations.

11. The method of claim 10, wherein measuring impairment correlations from the channel estimates includes varying a channel estimate across each slot such that measurements of the impairment correlations taken across the slot reflect changing fading conditions.

12. The method of claim 11, wherein varying a channel estimate across each slot comprises interpolating channel measurements across the slot such that a channel estimate value is a function of relative positioning within the slot.

13. The method of claim 12, wherein, for processing received Wideband Code Division Multiple Access (WCDMA) signals, interpolating channel estimates is based on a first number of pilot symbols received per slot for non-transmit diversity reception, and is based on a second number of pilot symbols received per slot for transmit diversity reception.

14. The method of claim 10, wherein calculating the second model fitting parameter for each time slot comprises summing selected diagonal elements of a measured impairment correlation matrix obtained by measuring impairment correlations for a received signal, and subtracting components from the summed diagonal elements to obtain an estimate of noise power.

15. The method of claim 14, wherein summing selected diagonal elements of a measured impairment correlation matrix obtained by measuring the impairment correlations, and subtracting components from the summed diagonal elements to obtain an estimate of noise power comprises summing main diagonal elements corresponding to on-path RAKE fingers and subtracting a second value determined by summing main diagonal elements corresponding to off-path RAKE fingers.

16. The method of claim 14, wherein calculating the first model fitting parameter for each time slot comprises summing differences between the measured impairment correlations and modeled impairment correlations as scaled by a function of the second model fitting parameter.

17. The method of claim 16, wherein summing differences between the measured impairment correlations and modeled impairment correlations as scaled by a function of the second model fitting parameter comprises summing differences between diagonal elements of a measured impairment correlation matrix and a modeled impairment correlation matrix included in the model.

18. The method of claim 16, further comprising setting a scaling of the second model fitting parameter to emphasize modeled noise components.

19. The method of claim 10, wherein calculating updated model fitting parameters for each slot based on the measured impairment correlations comprises performing a least squares fit of the model fitting parameters to make the weighted sum of modeled interference and noise correlation matrices substantially match the measured impairment correlations.

20. The method of claim 1, further comprising maintaining different state values for one or more of the model fitting parameters, so that scaling of the corresponding impairment terms is state dependent.

21. The method of claim 20, wherein the model includes an interference impairment term scaled by a first model fitting parameter, and wherein a received signal being processed comprises a Wideband Code Division Multiple Access (WCDMA) signal transmitted from a WCDMA base station having a first state wherein it actively transmits a High Speed Downlink Shared Channel (HS-DSCH) signal, and an inactive state wherein it does not actively transmit the HS-DSCH signal, and wherein maintaining different state values for one or more of the

model fitting parameters comprises maintaining first and second state values for the first model fitting parameter corresponding to the active and inactive states of the HS-DSCH signal.

22. The method of claim 21, further comprising selecting one of the state values for the first model fitting parameter based on one of receiving control information from the base station, or blindly estimating the base station state.

23. The method of claim 1, wherein providing a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters comprises modeling the received signal impairment correlations as a first interference covariance matrix scaled by a first model fitting parameter, a second interference covariance matrix scaled by a second model fitting parameter, and a noise covariance matrix scaled by a third model fitting parameter.

24. The method of claim 23, further comprising providing a first model for a first received signal of interest, and providing a second model for a second received signal of interest, and wherein the first and second received signals of interest include soft handoff traffic signals transmitted from first and second base station transmitters, respectively, and further comprising using the first and second fitting parameters from the first model as the second and first fitting parameters, respectively, in the second model.

25. The method of claim 1, wherein providing a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters comprises maintaining one of a combined model for two or more received signals of interest, or maintaining a separate model for each of two or more received signals of interest.

26. The method of claim 1, further comprising using modeled signal impairment correlations from the model to generate at least one of RAKE combining weights for RAKE combining

despread values of a received signal corresponding to the model, or generating signal quality estimates for the received signal.

27. The method of claim 1, wherein the recurring measurements of the received signal impairment correlations comprise estimating the received signal impairment correlations at successive instants in time based on interpolated channel estimates and adjusting the impairment correlations being modeled for spreading factor differences between received pilot signals and one or more received signals of interest.

28. The method of claim 1, wherein providing a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters comprises providing a combined model corresponding to impairment correlations associated with two or more transmit diversity signals received as signals of interest.

29. The method of claim 28, wherein providing a combined model comprises including impairment correlation measurements for each received signal of interest in a combined impairment correlation matrix, and solving for model fitting parameters associated with each signal of interest.

30. The method of claim 1, wherein adapting each of the model fitting parameters responsive to recurring measurements of the received signal impairment correlations comprises updating the impairment terms of the model at successive time instants based on current channel estimates and path delays for a received signal of interest, and calculating updated model fitting parameters to fit the updated impairment terms to currently measured received signal impairments.

31. The method of claim 30, wherein the model includes an interference impairment term comprising an interference covariance matrix that is updated at each time instant based on

current channel estimates, current RAKE finger delay assignments, and current received signal path delays.

32. The method of claim 31, wherein the model further includes a noise impairment term comprising a noise covariance matrix that is updated over one or more time instants based on an autocorrelation function of a received signal filter pulse and on current RAKE finger delay assignments.

33. The method of claim 1, wherein providing a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters comprises maintaining a model term for each of one or more received signals of interest.

34. The method of claim 1, wherein providing a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters comprises calculating at least one of the one or more impairment terms based on cross antenna values.

35. A computer readable medium storing a computer program for determining received signal impairment correlations for use in received signal processing, the computer program comprising:

program instructions to implement a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters; and

program instructions to adapt each of the model fitting parameters responsive to recurring measurements of the received signal impairment correlations.

36. A receiver circuit to determine received signal impairment correlations for use in received signal processing, the circuit comprising:

an impairment correlation estimator configured to measure received signal impairment correlations for a received signal of interest; and

one or more impairment modeling circuits configured to implement a model of received signal impairment correlations comprising one or more impairment terms scaled by corresponding model fitting parameters, and to adapt each of the model fitting parameters responsive to recurring measurements of the received signal impairment correlations as provided by the impairment correlation estimator.

37. The receiver circuit of claim 36, wherein the receiver circuit further comprises a RAKE combining weight generator configured to generate RAKE combining weights for RAKE combining despread samples of the received signal of interest based at least in part on the model of received signal impairment correlations.

38. The receiver circuit of claim 36, wherein the receiver circuit further comprises a Signal-to-Interference Ratio (SIR) estimation circuit configured to estimate a SIR for the received signal of interest based at least in part on the model of received signal impairment correlations.

39. A wireless communication terminal for use in a wireless communication network comprising:

a radio front-end circuit configured to provide one or more received signals of interest corresponding to one or more antenna-received signals; and

a receiver circuit configured to generate one or more RAKE combined signals by RAKE processing the one or more received signals of interest;

said receiver circuit configured to calculate RAKE combining weights by:

providing a model of received signal impairment for a received signal of interest comprising an interference impairment term scaled by a first fitting parameter and a noise impairment term scaled by a second fitting parameter; and

measuring received signal impairment correlations at each of one or more successive time instants and, at each time instant, adapting values of the first and second fitting parameters to fit the model to measured received signal impairment correlations.

40. The terminal of claim 39, wherein the receiver circuit is configured to update the model at each time instant based on current channel estimates and path delays for a received signal of interest such that instantaneous values of the first and second fitting parameters are calculated to fit current interference impairment and noise impairment terms to the measured received signal impairment correlations.

41. The terminal of claim 40, wherein the receiver circuit is configured to fit the model to the measured received signal impairment correlations by adapting the instantaneous values of the first and second fitting parameters comprises fitting the current interference impairment and noise impairment terms to the measured received signal impairment correlations using a Least Squares Estimation (LSE) process.

42. The terminal of claim 40, wherein the interference impairment term comprises an interference covariance matrix that is updated at each time instant based on current channel estimates, current RAKE finger delay assignments, and current received signal path delays.

43. The terminal of claim 40, wherein the noise impairment term comprises a noise covariance matrix that is updated over one or more time instants based on an autocorrelation function of a received signal filter pulse and on current RAKE finger delay assignments.

44. The terminal of claim 39, wherein the receiver circuit is configured to model the received signal impairment correlations as an interference covariance matrix scaled by the first fitting parameter and a noise covariance matrix scaled by the second fitting parameter.

45. The terminal of claim 39, wherein the receiver circuit is configured to initialize the model by setting the first fitting parameter to zero and setting the second fitting parameter to a positive value.

46. The terminal of claim 45, wherein the receiver circuit sets the second fitting parameter to a positive value by setting it to an estimate of received noise power.

47. The terminal of claim 39, wherein the receiver circuit is configured to provide a model for each of one or more transmitted signals of interest.

48. The terminal of claim 47, wherein despread values are obtained corresponding to respective ones of each of two or more transmit antennas, and wherein the receiver circuit is configured to provide a model term for sets of despread values corresponding to each transmit antenna.

49. The terminal of claim 39, wherein the terminal comprises a Wideband CDMA (WCDMA) terminal configured to receive signals from a WCDMA base station, and wherein the receiver circuit is configured to maintain a first value of the first fitting parameter corresponding to an active state of shared downlink channel transmission by the WCDMA base station, and a second value of the first fitting parameter corresponding to an inactive state of shared downlink channel transmission by the WCDMA base station.

50. The terminal of claim 39, wherein the receiver circuit is configured to maintain multiple values of one or both the first and second fitting parameter corresponding to different transmission conditions at one or more radio base stations transmitting signals received by the terminal.

51. The terminal of claim 39, wherein the receiver circuit is configured to calculate signal-to-interference ratios (SIRs) based on the model.

52. The terminal of claim 39, wherein the receiver circuit is configured to adapt values of the first and second fitting parameters to fit the model to measured received signal impairment correlations based on estimating the second fitting parameter as a noise power value, and computing the first model fitting parameter based on removing a noise term from the measured received signal impairment correlations as a function of the calculated second fitting parameter.

53. The terminal of claim 52, wherein removing a noise term from the measured received signal impairment correlations as a function of the calculated second fitting parameter comprises applying a mapping function to the second fitting parameter to give the noise power a desired weighting, and subtracting the weighted noise power from the measured received signal impairment correlations.

54. The terminal of claim 39, wherein each successive time instant comprises a defined time slot, and wherein the receiver circuit is configured to measure received signal impairment correlations for each slot based on determining differences between each of a plurality of despread values generated over the slot and a channel estimate that varies over the slot to reflect changing fading conditions.

55. The terminal of claim 39, wherein the receiver circuit is configured to adapt values of the first and second fitting parameters to fit the model to measured received signal impairment correlations based on least squares fitting the model to the measured received signal impairment correlations.

56. A method of received signal processing comprising:

receiving one or more signals of interest during each of a succession of time slots;

generating channel estimates over each time slot;

measuring impairment correlations for the one or more signals of interest based on the channel estimates;

updating each term of an impairment correlation model based on the measured impairment correlations; and

generating in each time slot at least one of RAKE combining weights for combining despread values for the one or more signals of interest, and signal quality measurements for the one or more signals of interest.

57. The method of claim 56, wherein updating each term of an impairment correlation model based on the measured impairment correlations comprises updating a modeled interference correlation matrix by updating a corresponding first scaling factor and updating a modeled noise correlation matrix by updating a corresponding second scaling factor.

58. The method of claim 57, wherein updating a modeled interference correlation matrix by updating a corresponding first scaling factor and updating a modeled noise correlation matrix by updating a corresponding second scaling factor comprises calculating the second scaling factor by estimating a noise power, and calculating the first scaling factor by removing values using the second scaling factor from elements in a measured impairment correlation matrix representing the measured impairment correlations.

59. The method of claim 58, wherein calculating the first scaling factor by removing values using the second scaling factor from elements in a measured impairment correlation matrix representing the measured impairment correlations comprises generating the values from the second scaling factor based on a desired weighting emphasis to noise power.